

Serial No. 10/779,826
Amendment dated 04/22/05
Office Action dated 02/23/05

RD-29,572-2

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

1. (Currently amended) A method for determining at least one of past-service conditions and remaining useful life of at least one of a component of a combustion engine and a thermal barrier coating thereof, said method comprising:
 - (1) providing a combustion-engine component comprising a thermal barrier coating that comprises at least one photoluminescent ("PL") material that ~~can be~~ is capable of being excited by a first radiation at a first wavelength range and ~~emits~~ is further capable of emitting a second radiation at a second wavelength range different from said first wavelength range in response to said first radiation; said second radiation having a characteristic property that correlates with an amount of a crystalline phase in said thermal barrier coating, which amount changes as said combustion-engine component is exposed to elevated temperatures;
 - (2) directing said first radiation having said first wavelength range at said thermal barrier coating of said combustion-engine component;
 - (3) measuring said characteristic property of said second radiation;
 - (4) determining said amount of said crystalline phase present in said thermal barrier coating from said characteristic property of said second radiation; and
 - (5) determining at least one of past-service conditions and remaining useful life of at least one of said component of said combustion engine and said thermal barrier coating thereof from said amount of said crystalline phase.
2. (Original) The method according to claim 1, wherein said thermal barrier coating comprises zirconia stabilized with at least one material selected from the group

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consisting of yttria, yttrium aluminum oxide garnet, calcia, magnesia, india, scandia, and ytterbia.

3. (Original) The method according to claim 1, wherein said thermal barrier coating comprises a material selected from the group consisting of yttria-stabilized zirconia and yttria-partially-stabilized zirconia.
4. (Original) The method according to claim 3, wherein yttria is present at an amount from about 6 to about 8 weight percent of said thermal barrier coating.
5. (Original) The method according to claim 1, wherein said PL material is yttria doped with at least one a rare-earth metal ion.
6. (Original) The method according to claim 2, wherein said at least one material is doped with at least one rare-earth metal selected from the group consisting of europium, samarium, terbium, dysprosium, erbium, praseodymium, gadolinium, holmium, and thulium.
7. (Original) The method according to claim 5, wherein said rare-earth metal is europium.
8. (Original) The method according to claim 1, wherein said first wavelength range is an ultraviolet range.
9. (Currently amended) The method according to claim 1, wherein said first wavelength range is a visible light range of wavelengths less than about 450 nm.
10. (Original) The method according to claim 1, wherein said second radiation is a visible light.
11. (Original) The method according to claim 1, wherein said second radiation is a near IR radiation.
12. (Original) The method according to claim 1, wherein said crystalline phase is a monoclinic phase.

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13. (Original) The method according to claim 12, wherein said characteristic property is an intensity of a peak at about 615 nm in an emission spectrum.
14. (Original) The method according to claim 12, wherein the step of determining said amount of said crystalline phase comprises correlating a ratio of intensities of peaks at about 615 nm and about 605 nm with known amount of the monoclinic phase.
15. (Original) The method according to claim 1, wherein the step of determining at least one of past-service conditions and remaining useful life of at least one of said component of said combustion engine and said thermal barrier coating comprises correlating said amount of said crystalline phase with data selected from the group consisting of known historical temperature and time to failure of an engine component.
16. (Currently amended) A method for determining at least one of past-service conditions and remaining useful life of at least one of a component of a combustion engine and a thermal barrier coating thereof, said method comprising:
- (1) providing a combustion-engine component comprising a thermal barrier coating that comprises at least two PL materials that ~~can be~~ are capable of being excited by a first radiation at a first wavelength range and ~~emits~~ are further capable of emitting at least a second radiation in a second wavelength range different from said first wavelength range in response to said first radiation, said second radiation emitted by each of said PL materials having a different characteristic property attributable to each of said PL materials, said characteristic property correlating with an amount of a crystalline phase in said thermal barrier coating, which amount increases as said combustion-engine component is exposed to elevated temperatures;
 - (2) directing said first radiation having said first wavelength range at said thermal barrier coating of said combustion-engine component;
 - (3) measuring said characteristic property of said second radiation;

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- (4) determining said amount of said crystalline phase present in said thermal barrier coating from said characteristic property of said second radiation;
- (5) determining a remaining amount of said thermal barrier coating; and
- (6) determining at least one of past-service conditions and remaining useful life of at least one of said component of said combustion engine and said thermal barrier coating thereof from said amount of said crystalline phase and said remaining amount of said thermal barrier coating.

17-36 (Canceled)